Salmonellosis in Hawaii: 1987 to 1990

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After an overview of salmonellosis, its epidemiology is described and techniques are discussed by which the disease could be brought under control. A review is made of all salmonellosis cases reported to the Department of Health Epidemiology Branch for calendar years 1987 to 1990. This data is compared with national and state laboratory data. Reports received by the Epidemiology Branch often lack sufficient information; this accounts for the sizable "unknown" entries. This frustrates a person's understanding of a more accurate incidence of the disease.

Introduction

Salmonellosis in Hawaii was reviewed comprehensively in 1984[1]. The purpose of our report is to review the incidence and prevalence of salmonellosis in Hawaii from 1987 to 1990. The analysis is based on data from the reports of the Epidemiology Branch[2], the Department of Health annual *Statistical Report*[3] and information from the State Laboratory[4]. A case of salmonellosis was defined by the isolation of *Salmonella* subspecies (spp) by a diagnostic laboratory.

Salmonellae infect humans as well as many species of animals. Identical serotypes can be found in both populations. Several taxonomic systems have been used to classify salmonellae with the most common method recognizing 3 species: *S. typhi, S. cholera-suis*, and *S. enteriditis*. The prototype of enteric fevers, typhoid fever, is caused by *S. typhi,* found only in humans[5]. All other salmonellae infect both animals and humans with more than 2,000 species (serotypes) of *S. enteritidis. S. enteritidis* subspecies are usually referred to by their subspecies name only, eg *S. typhimurium, S. arizona*, etc. *S. cholera-suis* can be responsible for generalized Salmonella septicemia with focal lesions to be found anywhere in the body. Most large outbreaks of salmonellosis involve one of the *S. enteritidis* serotypes.

Epidemiological investigations show that outbreaks of the disease often are attributed to improper food processing, food handling or storage. At any point from food production to food consumption, contamination with salmonellae can take place with human infection as a result.

Salmonellae are killed readily by heat at 55°C (131°F) for one hour or in 15 to 20 minutes at 60°C (140°F)[6]. The length of time the food item is heated affects the degree of penetration of the heat. An unthawed piece of meat or packaged food will obviously heat unevenly with the cooler core likely to provide a nidus for possible later contamination. Animal salmonellosis can lead to human infection if meat, meat byproducts or eggs are cooked only partially, or if milk is not pasteurized. Salmonella contamination of meat and eggs can be deep-seated and good heat penetration is imperative.

Salmonellae can spill from animal viscera and feces during the preparation of carcasses in the slaughterhouse, during the milking of animals, or by fowl while they lay eggs. The bacteria can course through the blood of poultry and be present within the magma of eggs. With the introduction of antibiotics into animal feeds, the resistance to antibiotics by Salmonellae has increased. Domestic fowl probably constitute the largest single reservoir of salmonellae[6].

A recent investigation of an outbreak in Hawaii established that 9.43% of the eggs randomly sampled in Honolulu supermarkets were contaminated on the shell surface by salmonellae[7]. Further investigation pinpointed a producer's faulty egg-sanitizer's temperature-control mechanism as an etiological factor. In that report, the investigator correlated 16 cases of salmonellosis in 1989 with serotypes isolated from eggshells[7].

For the sake of expediency, foods often are prepared long before they are consumed. In order to avoid overcooking, these foods are often kept at low heat, thereby ensuring an ideal medium for bacterial growth and then quickly re-heated before serving. The USDA recommends that thorough reheating of previously prepared foods be done at 165°F or higher before being served[8].

In reported outbreaks of salmonellosis, the implicated food was frequently prepared early in the day before being consumed several hours later, either without adequate refrigeration or without proper re-heating. Both proper heating and refrigerating can effectively attenuate the presence of Salmonellae. Salmonella overgrowth is kept at a minimum at temperatures below 5°c (41°F).

For transient, uncomplicated enterocolitis caused by one of the *S. enteritide* spp, specific medication is generally unnecessary and treatment is supportive, consisting only of rehydration and electrolyte replacement. The use of antibiotics may help propagate resistant strains and increase the likelihood of a carrier state. Since the biliary tract is usually unaffected by gastric acidity, yet proximal enough to the GI tract, its higher pH can provide a refuge for Salmonellae, especially *S. typhi*. Cholecystectomy is generally curative for up to 80% of the population of carriers[9].

Although most human infections with *salmonella* spp are self-limited and often unreported, the cases presented to health services frequently involve very old or very young people. In such cases the morbidity may be significantly high.

Discussion

Incidence

When the rates for salmonellosis are compared by year for Hawaii and the nation, Hawaii has an incidence nearly 2 1/2 times that in the nation as a whole (Table 1). Hawaii's

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Table 1:

Comparison of Incidence Rates
Hawaii and Nation: 1987 to 1989

State of Hawaii	Nation
1987 42.6/100,000 population	1987 42.6/100,000 population
1988 44.07/100,000 population	1988 17.809/100,000 population
1989 33.0/100,000 population	1989 16.8/100,000 population

*Source: Statistical Report, DoH and State Laboratory
**Source: Annual Summaries on Salmonella Surveillance, CDC, 1989

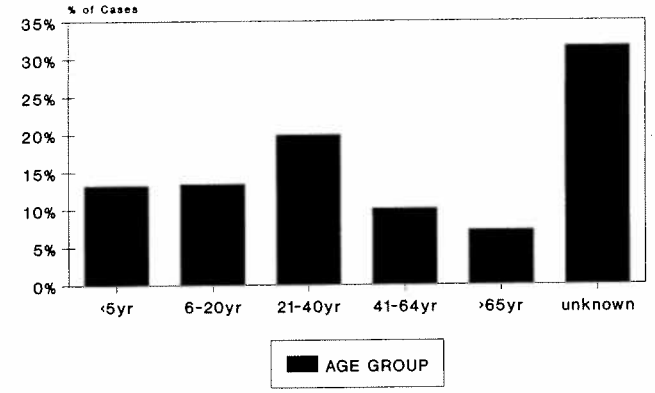
Table 2:

State of Hawaii, Incidence of Salmonellosis
Serotype* and Calendar Year
(reporting restricted to 10 or more cases per year)

Serotype	Year			
	1987	*1988*	*1989*	*1990*
Agona	15	14	13	16
Anatum		25		
Berta			12	
Enteriditis		13	12	
Hadar		19	21	15
Heidelberg	38	31	56	30
Infantis				16
Muenchen		13		16
Newport	15	19	10	16
Oslo		12		
Oranienberg		22		
Panama			11	
St Paul			13	13
Typhi, Phage Types A, M, E & E1				12
Thyphimurium	27	123	35	107
Thyphimurium var Cop			22	37
Weltevreden	29	70	66	40
Montivideo	10		10	
Unreported serotypes	261	23	4	9
Others (incidence of 9 or less cases reported)	67	138	102	120
Totals Cases	***462***	***522***	***387***	***447***

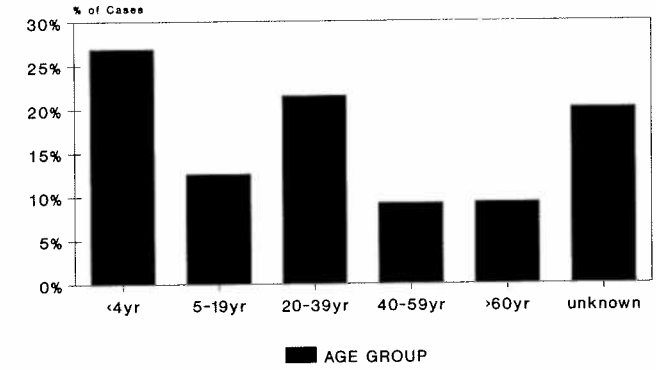
*Source: Statistical Report, DoH and State Laboratory
**Source: Annual Summaries on Salmonella Surveillance, CDC, 1989

Figure 1
Age Distribution (%) of Salmonella Cases
Hawaii, Calendar Year 1987



Source Epidemiology Branch

Figure 2
Age Distribution (%) of Salmonella Cases
Nation, Calendar Year 1987



Source: CDC

rate in 1990 was 39.3 per thousand persons. At the time of this writing, national figures for 1990 have not been published.

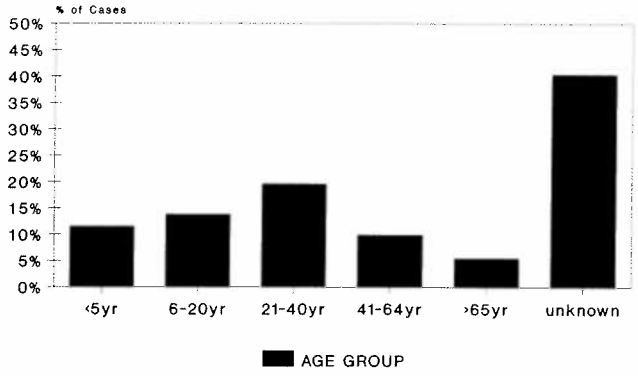
What accounts for this higher incidence of salmonellosis in Hawaii when compared with the rest of the U.S.? One suggestion is that our small population base and small geographic size results in better surveillance than in the rest of the United States. Cultural food preferences and sites of food consumption might be other factors contributing to the high incidence of the disease. Another contributing epidemiological factor is that salmonellosis reporting is mandatory in Hawaii.

Seasonal variation

The date of onset of the disease is usually not submitted to the Department of Health (DoH); hence, temporal analysis can be done only by the time and date of the report. A time lag of not more than one month between date of onset and date of report was usually observed when dates of onset and dates of report were both available.

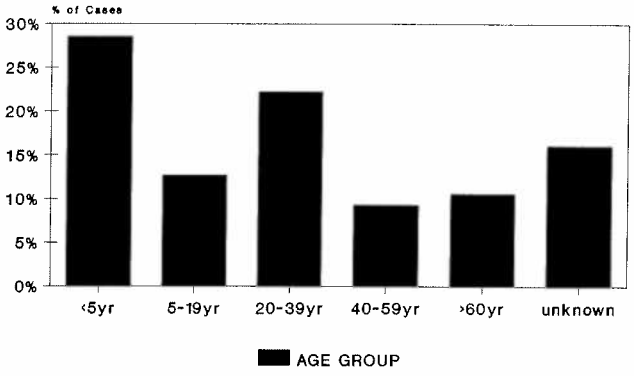
Dates of reporting by months of confirmed Salmonella cases to the DoH are shown in Figure 8. Note the consistently low level of incidence for a period of approximately 8 months, and an increase during the summer and autumn months. There has never been an explanation for this observation except that it might be attributed to increased recreational activity, an increase in tourism and the greater consumption of *picnic-type foods*, traditional among Hawaii residents during those months.

Figure 3
Age Distribution (%) of Salmonella Cases
Hawaii, Calendar Year 1988



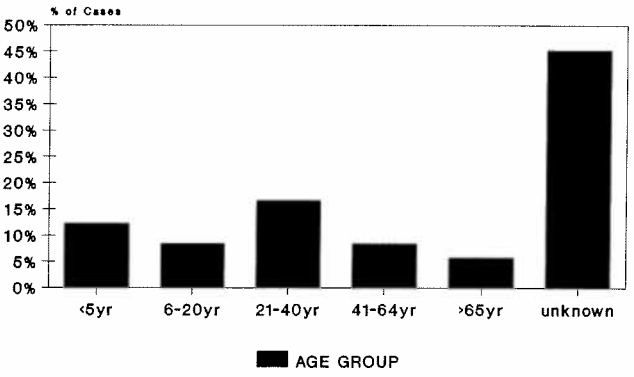
Source: Epidemiology Branch

Figure 4
Age Distribution (%) of Salmonella Cases
Nation Calendar Year 1988



Source: CDC

Figure 5
Age Distribution (%) of Salmonella Cases
Hawaii Calendar Year 1989



Source: Epidemiology Branch

Age

National data for 1990 are not available at this writing. It was possible to compare only state and national age distribution statistics for 1987 (Figure 1 and Figure 2), 1988 (Figure 3 and Figure 4) and 1989 (Figure 5). The <5-year-old group is a smaller percentage of the total reported cases in Hawaii accompanied with the cases in the U.S. in both 1987 and 1988. A smaller percentage of cases among the younger than 5-year-old group is unexplained but it may be accounted for by the rather large numbers in the category labeled "unknown age".

Serotypes and their relationship to etiology

The most frequently occurring serotypes for Hawaii are listed according to the number of human cases of salmonellosis reported (Table 2).

It has been difficult to correlate particular serotypes of *Salmonella* spp with particular foods, since laboratory and epidemiology reports generally do not indicate the source of the infection. However some serotypes are generally associated with particular animal reservoirs. For example, in the 1987 barbecued chicken outbreak[10], the 67 culture-confirmed cases were of the *S. agona* serotype, commonly found in poultry. Poultry flocks also may be heavily infected with *S. typhimurium*[11].

In preparation for the annual Honolulu Marathon in early December 1987, a high carbohydrate meal was prepared for the contestants several days before the event. This banquet meal resulted in 288 clinical cases of Salmonellosis with eventual laboratory-cultured confirmation of 25 cases. *S. weltevreden*, a common serotype in Hawaii, was cultured in all of the confirmed cases[12].

Apart from a few isolated incidents in which a particular serotype was responsible for a large outbreak of disease, it is difficult to associate specific serotypes with particular foodstuffs in Hawaii. Investigation into this area might help to reduce the disease outbreaks.

Reporting

A more accurate understanding of salmonellosis in Hawaii has been frustrated by incomplete communicable disease reports submitted to the Epidemiology Branch. These reports are required to be submitted by physicians, clinics and hospitals as soon as possible after the diagnosis of a reportable disease. The misleading or incomplete information provided in these reports is evidenced by the category of "unknown age" in the reports.

On the national level, the younger-than-5 age group accounts for more than 25% of the total cases of salmonellosis[13]. Available figures in our Epidemiology Branch account for less than 15% of all cases under age 3[2]. On the other hand, State Laboratory reporting shows high levels of incidence among the younger age groups during fiscal year (FY) 1987 to FY 1990[4]. The majority of these cases in the ≤age-3 group show a mean percentage of 38.02% of the total number of cases reported over the 4-year period (see Figure 6). These figures are higher than the reported national percentage totals for the respective age groupings. A comparison between these reported percentages is highlighted in Figure 7.

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Conclusion

Although surveillance data can provide a basis for policy, if the data are incomplete because of poor reporting practices, conclusions about the existing data can be misleading. In order to accomplish a more comprehensive survey of salmonellosis in Hawaii, it was necessary to compare the available data in the Epidemiology Branch[2] with that in the State Laboratory[4] and in the Centers for Disease Control (CDC) *Annual Summaries on Salmonella Surveillance*[13].

Better cooperation is needed between the Hawaii DoH and the medical community in the direction of better reporting procedures. These should be honest, complete and provide only pertinent information; they should be submitted on a timely basis.

Consistently good reports should receive accolades; poor reports should be singled out for follow-up with suggestions to the reporter for improvement.

It is usually the responsibility of public health workers to determine the causative factors of a disease outbreak and to initiate control measures to decrease morbidity and mortality. However, common sense dictates that greater attention to very simple and yet effective measures of food preparation and storage by the general public can decrease the incidence and prevalence of the disease in Hawaii. As has been pointed out in this discussion, meat, chicken, eggs and milk account for most of the outbreaks of infection by *Salmonella* spp. Often this is a function of the lengthy journey from field and farmyard to the eating table.

Although most people have little control over the production of food, there is a degree of control that people can exercise over the subsequent storage, handling and ultimate serving of food.

Because salmonellae are ubiquitous in our environment, the general public needs to be aware of the problem. Its role in preventing infection within the home and in dining establishments needs to be emphasized.

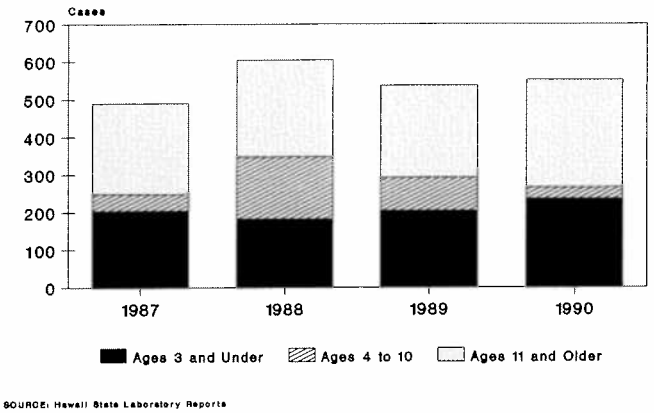
ACKNOWLEDGEMENTS

Suggestions about the subject and subsequent review of this material have been made by Eugene Pon MD, Henri Minette, DPH and David Sasaki DVM MPH of the State Epidemiology Branch and Al Katz MD, Professor of Epidemiology at the University of Hawaii, School of Public Health. Their recommendations are appreciated. Thanks also are extended to Mr. John Tawney for his assistance in putting the manuscript together.

REFERENCES

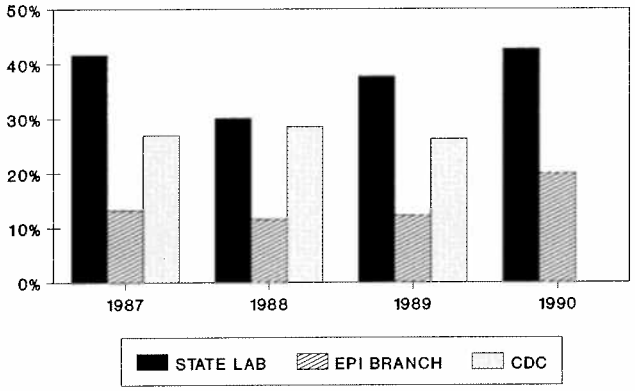
1. Minette HP, Sasaki DM. *Salmonellosis in Hawaii 1984.* Unpublished report: 1-8.
2. Data on *Salmonella* is taken from computer records in the Epidemiology Branch, Department of Health. Honolulu: 1987-88.
3. *Annual Statistical Report.* Department of Health. Research and Statistics Office. Honolulu, HI: 1987-88.
4. Disease reports for *Salmonella* as recorded in laboratory log books. State Laboratory. Department of Health. Honolulu, HI; 1987-90.
5. Last JM, et al. *Public Health and Preventive Medicine.* 12th ed. Appleton-Century-Crofts. Norwalk, Conn: 1986;239.
6. Christie AB. *Infectious Diseases, Epidemiology and Clinical Practice.* 2nd ed. Churchill and Livingstone. London, England: 1977;3-54.
7. Lee MR. *Salmonella Egg Survey in Hawaii.* Unpublished Master's Thesis at University of Hawaii. School of Public Health: 1989:11/21.
8. U.S. Department of Health, Education and Welfare. *Food Service*

Figure 6
SALMONELLOSIS STATE LABORATORY REPORT
FY 1987 to FY 1990



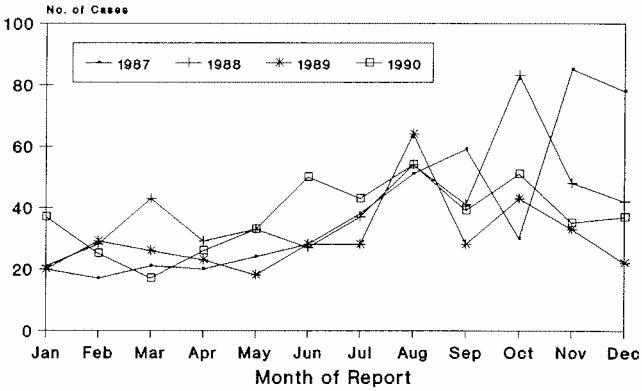
SOURCE: Hawaii State Laboratory Reports

Figure 7
Comparison of Salmonellae Reports
Incidence in Children: 5 years & younger



SOURCE: State Lab, Epi & CDC Reporting

Figure 8
Monthly Incidence of Salmonellosis
Hawaii, 1987-1990



SOURCE: Epidemiology Branch

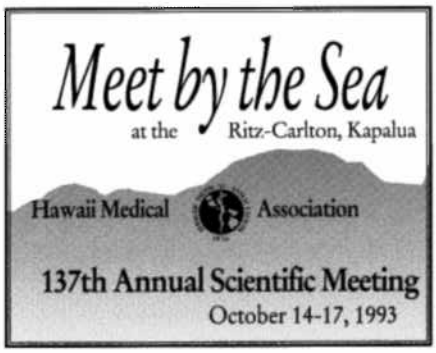
(Continued on page 226) ➤

VIEWPOINT
(Continued)

where and what grocery outlets should be allowed (and to deny certain ones), or to dictate the sale of automobiles, or to decide what any other legitimate business enterprise should be allowed, if they were faced with such an abusive statute, we can be certain that the law would be struck down. Why therefore is medical business treated in this manner? One is inevitably led to the conclusion that the state Department of Health with its posturing gurus is determined to squash any sort of private competition.

This law must be discarded—not modified, not cleaned up, not corrected—simply discarded. Planning from the top fails, and there are truly thousands of irrefutable examples to establish that fact. The Berlin Wall came crashing down, remember?

■



SALMONELLOSIS IN HAWAII: 1987 TO 1990
(Continued from page 214)

Manual. DHEW Publication FDA #78-2081. Washington, D.C.: 1976;28-30.
9. Nelson WE, et al. *Textbook of Pediatrics*. 11th ed. WB Saunders and Company. Philadelphia, Penn: 1979;780.
10. Hawaii Department of Health. *Salmonella agona outbreak final report*: 1988;4/22.
11. Nationwide studies conducted by the USDA show about thirty-five percent of the poultry tested have salmonella: News release, DOH-OD #90-46: 1990;27 April.
12. Hawaii Department of Health. *Honolulu Marathon Carbo-Loading Foodborne Outbreak Final Report*: 1988;3 March.
13. *Annual Summaries on Salmonella Surveillance*. Centers for Disease Control. U.S. Department of Health and Human Services: 1989.

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Erratum:
In a recent Journal isssue (52/6–June 1993) on p. 168, right head column in the paragraph near the bottom beginning with "According to the author...", the sentence should read:
"Recently, the 1975 ogre of sudden death", instead of Sudden Infant Death. The author, Bob Dimler, of the article ADHD REvisited, brought this to our attention and added; "Although I will say I've seen a few 'hyperactive' babies. The sudden deaths have been of cardiac origin." Sorry, Bob, the error may too have been "whimsical" on our part.

The editor

ONE RX FOR SOLO SURVIVAL
(Continued from page 218)

educated and committed to accepting the changes in the way they practice.

Being more efficient in business will be one of the ways physicians can allow themselves the time to practice their skills. To accomplish this task, it will require skilled assessment of the one practice, and a commitment to accept new and innovative ideas. The reward could well be the achievement of that dream in the front year of medical school: Of being a healer and clinician, rather than a paper pusher!

■

(Mrs. McKenzie has been involved in health care for many years. Her emphasis and research in law school was in the medical-legal area. She has written and made speeches in local and international forums. An active member of the local medical community, Mrs. McKenzie is presently a marketing consultant.)

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